

CLAIMS

Sub B1
5 1. Optical device for focusing a laser beam, comprising:
- a source of emission of a laser beam;
- a focusing lens of the laser beam;
- first means adapted to select a central portion of the laser beam;
characterised in that said first means are directly applied on the focusing lens.

10 2. Device according to claim 1, wherein the laser beam is a substantially elliptic and astigmatic beam.

3. Device according to claim 1, wherein the first means ~~define~~ ^{comprises means defining} on the focusing lens an aperture having a Fresnel number which is smaller than 2 along a fixed reading direction.

15 4. Device according to claim 3, wherein said aperture has a Fresnel number smaller than 1.2 along said reading direction.

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20 5. Device according to claim 3, wherein said aperture has a Fresnel number smaller than 2 along an orthogonal direction with respect to said reading direction.

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25 6. Device according to claim 1, wherein said first means comprises ^a coating ~~means made~~ of a substantially opaque material, applied on a peripheral portion of a front surface of the focusing lens so as to allow the propagation of the central portion of the laser beam, and obstruct the propagation of a surrounding portion of beam.

7. Device according to claim 6, wherein said coating means are applied on the front surface of the focusing lens faced on the opposed side with respect to the source of emission.

30 8. Device according to claim 6, wherein said coating means

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are applied according to ^{at least} ~~any~~ one of the following methods: spraying, sputtering, evaporation, printing, painting.

5 9. Device according to claim 1, wherein said first means comprises a diaphragm having a central aperture adapted to allow the propagation of the central portion of the laser beam, and a surrounding surface adapted to obstruct the propagation of a surrounding portion of beam, the lens and the diaphragm comprising opposed front surfaces, of conjugate shape, adapted to be reciprocally coupled.

10 10. Device according to claim 9, further comprising an adhesive which is interposed between the diaphragm and the focusing lens.

15 11. Device according to claim 1, wherein the focusing lens and said first means constitute a single optical element comprising, in a central portion, the focusing lens and, in a surrounding portion, means adapted to separate the central portion of the beam from the surrounding portion of beam.

20 12. Device according to claim 11, wherein said focusing lens is a diffracting lens made by a diffracting technology.

25 13. Device according to claim 11, wherein said means adapted to separate the central portion of the beam from the surrounding portion of beam comprises a surface made of a substantially opaque material, which is adapted to obstruct the propagation of the surrounding portion of beam.

30 14. Device according to claim 11, wherein said means adapted to separate the central portion of beam from the surrounding portion of beam comprises a surface made of a diffusing material, adapted to disperse the surrounding

portion of beam.

B 15. Device according to claim 14, wherein the surface of diffusing material is shaped according to ~~any~~ one of the following types of lens: divergent Fresnel lens, refractive
5 lens, diffractive lens.

16. Device according to claim 1, comprising means for allowing the optical alignment between source of emission and focusing lens.

10 17. Device according to claim 16, wherein the means for allowing the optical alignment between source of emission and focusing lens comprises a substantially tubular portion of lens which extends from a front surface of the focusing lens and is adapted to be mounted by interference on a support structure of the source of emission, said
15 substantially tubular portion comprising an inner wall provided with at least two teeth extended in a substantially radial direction and adapted to be housed into corresponding housings obtained on the support structure of the source of emission.

B 20 18. Device according to claim 17, further comprising an adhesive interposed between the support structure of the source of emission and (the) substantially tubular portion of the focusing lens.

25 19. Device according to claim 18, wherein said adhesive is a thermally conductive glue.

B 20. Device according to claim 17, wherein the inner wall of (the) substantially tubular portion of the lens is coated with ~~means made of~~ a substantially opaque material.

30 21. Device according to claim 16, wherein the means for allowing the optical alignment between the source of

Consolidated C4

propagation of a central portion of the laser beam, and a surrounding surface adapted to obstruct the propagation of a surrounding portion of beam, the lens and the diaphragm comprising opposed front surfaces, having conjugated shape, adapted to be reciprocally coupled.

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29. Optical element for focusing a laser beam, ~~characterised in that it comprises~~ *said element comprising*, in a central portion, a focusing lens adapted to allow the propagation of a central portion of the laser beam and, in a surrounding portion, means adapted to separate the central portion of the beam from a surrounding portion of beam.

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30. Apparatus for assembling an optical device according to ~~any one of claims from 22 to 25~~ *22*, characterised in that it comprises a support frame for the container and substantially automatic displacement means that are active on the source of emission to position the latter inside the container.

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31. Method for assembling a device according to ~~any one of claims from 22 to 25 by means of the apparatus of claim 30~~ *22*, characterised in that it comprises the following steps:

- inserting the focusing lens inside the container till abutment occurs;
- inserting the laser diode inside the container by the displacement means;
- observing the image of the spot caught by a sensor located at a fixed distance from the container, as the laser diode is inserted in the container;
- stopping the laser diode displacement means when the image of the spot observed presents predetermined dimensions and shape;
- fixing the laser diode into position.

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